AMENDMENTS TO THE SPECIFICATION:

Please amend the specification as follows:

IN THE TITLE:

Please delete the present title, and substitute therefor the following new title:

--APPARATUS FOR APPLYING A REACTION FORCE TO A PIVOTALLY SUPPORTED PEDAL MEMBER UPON DEPRESSION THEREOF--

IN THE ABSTRACT:

Please delete the present Abstract, and substitute therefor the following new Abstract:

An apparatus for applying a reaction force to a pedal member which is pivotally supported by a support shaft and which is depressible to be pivoted about an axis of the support shaft. The apparatus includes: (a) a changeable reaction-force applying device for applying the reaction force to the pedal member and changing the reaction force; and (b) a reaction-force controlling device for controlling the changeable reaction-force applying device such that the reaction force is changed on the basis of a depressing stroke of the pedal member, according to a predetermined pattern of change of the reaction force.

IN THE SPECIFICATION:

Please replace section [0033] with new section [0033] as follows:

[0033]

Preferred embodied forms of the present invention will be explained in more detail. One embodied form is characterized in that the pedal reaction force applying

apparatus according to any one of ~~claims 1-7~~ the first through seventh aspects of the invention is used in an electric service brake pedal device for a vehicle.

Another embodied form of the invention is characterized in that the spring member of ~~claim 2~~ the second aspect of the invention is a single one compression coil spring.

Still another embodied form of the invention is characterized in that the spring member of ~~claim 2~~ the second aspect of the invention is a single one tension coil spring.

Still another embodied form of the invention is characterized in that the spring member of ~~claim 2~~ the second aspect of the invention serves also as return spring for pivoting the pedal member in a direction toward its home position.

Still another embodied form of the invention is, in ~~claim 3~~ the third aspect of the invention, characterized in that the spring member is held in a predetermined position by a holding member, such that the spring member is connected at one of its opposite ends with the pedal member, pivotably about a connecting axis parallel with the support axis, and such that the spring member is engaged at the other of its opposite ends with the engaged portion of the cam member, movably relative to the engaged portion of the cam member, so that the other end of the spring member is displaced by pivot motion of the engaged portion of the cam member.

Still another embodied form of the invention is, in ~~claim 3~~ the third aspect of the invention, characterized in that the engaged portion of the cam member is constructed to have an outer circumferential surface of the cam member whose distance from the pivot axis is continuously changed.

Still another embodied form of the invention is, in ~~claim 5~~ the fifth aspect of the invention, characterized in that the transmission mechanism is constructed to have a first pulley which is provided in a supported portion of the pedal member, so as to be pivoted together with the pedal member about the support axis, a second pulley which is provided in a reaction-force changing mechanism such as the cam member, and a timing belt which connects the first and second pulleys.

Still another embodied form of the invention is, in ~~claim 5~~ the fifth aspect of the invention, characterized in that the transmission mechanism is constructed to have a first meshing member which is provided in a supported portion of the pedal member, so as to be pivoted together with the pedal member about the support axis, and a second meshing member which is provided in a reaction-force changing mechanism such as the cam member and which is held in meshing engagement with the first meshing member.

Still another embodied form of the invention is, in ~~claim 6~~ the sixth aspect of the invention, characterized in that the drive device is an electric motor which rotates a reaction-force changing mechanism such as a cam member and a feed screw mechanism.

Please replace paragraph [0035] with new paragraph [0035] as follows:

[0035]

The pedal member 16 is pivotably connected at its upper end portion with the support shaft 14, and is pivoted about the axis of the support shaft 14 in the clockwise direction as a result of an operator's depression operation effected on a pad portion 24 which is provided by a lower end portion of the pedal member 16. An amount of the

pivot motion of the pedal member 16 is detected by a not-shown sensor (such as a stroke sensor 88 in Fig. 5), so that a braking force corresponding to the detected amount of the pivot motion is generated by a hydraulically or otherwise operated brake. ~~Fig. 1 (a)~~ Fig. 1A shows a state in which the pedal member 16 is held in its home position before the depression of the pedal member 16, ~~while Fig. 1 (b)~~ Fig. IB shows a state in which the pedal member 16 is being operated to be depressed.

Please replace paragraph [0036] with new paragraph [0036] as follows:

[0036]

The cam member 20 is disposed on a front side of the pedal member 16 as viewed in a vehicle running direction, and is mechanically pivoted about the axis of the pivot shaft 18 by a transmission mechanism 26, upon depression of the pedal member 16. The transmission mechanism 26 is equipped with a first pulley 28 which is disposed pivotably about the axis of the support shaft 14 so as to be pivoted together with the pedal member 16, a second pulley 30 which is disposed pivotably about the axis of the pivot shaft 18 so as to be pivoted together with the cam member 20, and a timing belt 32 which connects the first and second pulleys 28, 30, for transmitting the pivot motion of the pedal member 16 to the cam member 20. The cam member 20 is pivoted, as shown in ~~Fig. 1 (b)~~ Fig. 1B, about the axis of the pivot shaft 18 by a predetermined angle in the clockwise direction as indicated by arrow A, as a result of depression of the pedal member 16. An amount of the pivot motion of the cam member 20 in relation with the depressing stroke of the pedal member 16 can be suitably determined depending upon ~~a gear ratio (ratio of diameter)~~ ratios of diameters of the pulleys 28, ~~20~~ 30.

Please replace paragraph [0037] with new paragraph [0037] as follows:

[0037]

The cam member 20 has an integrally-formed lobe portion 34 which outwardly projects such that its diameter is continuously changed, and which serves as an engaged portion of the cam member 20. The compression coil spring 22 is forced, by its own spring force, onto an outer circumferential surface of the cam member 20. When the cam member 20 is clockwise pivoted about the axis of the pivot shaft 18 as a result of depression of the pedal member 16, the lobe portion 34 takes a posture projecting toward the compression coil spring 22 as shown in ~~Fig. 1 (b)~~ Fig. 1B, so that an end portion of the compression coil spring 22 held in engagement with the cam member 20 is continuously displaced, depending upon a projection amount and a projection shape of the lobe portion 34, in a direction away from the pivot shaft 18.

Please replace paragraph [0039] with new paragraph [0039] as follows:

[0039]

In this arrangement, when the pedal member 16 is operated to be depressed as shown in ~~Fig. 1 (b)~~ Fig. 1B, the compression coil spring 22 is compressively deformed in its axial direction between the pedal member 16 and the cam member 20, so that a pedal reaction force is applied to the pedal member 16 as a result of the compressive deformation of the compression coil spring 22. Further, owing to the transmission mechanism 26, the depression of the pedal member 16 causes also a clockwise pivot motion of the cam member 20 about the axis of the pivot shaft 18, whereby the spring seat 40 is displaced by the lobe portion 34 of the cam member 20, in a direction away

from the pivot shaft 18. Owing to the displacement of the spring seat 40 in the direction away from the pivot shaft 18, an amount of the elastic deformation of the compression coil spring 22, i.e., the pedal reaction force applied to the pedal member 16 is changed in accordance with a predetermined non-linear change pattern. The cam member 20 corresponds to the reaction-force changing mechanism, and cooperates with the compression coil spring 22 as the spring member to constitute a changeable reaction-force applying device 44. The transmission mechanism 26 serves as a reaction-force controlling device.

Please replace paragraph [0044] with new paragraph [0044] as follows:

[0044]

A pedal reaction force applying apparatus 50 of Fig. 2 is different from the above-described embodiment in its transmission mechanism 52. That is, the transmission mechanism 52 is equipped with a first fan-shaped meshing member 54 which is disposed pivotably about the axis of the support shaft 14 so as to be pivoted together with the pedal member 16, and a second fan-shaped meshing member 56 which is disposed pivotably about the axis of the pivot shaft 18 so as to be pivoted together with the cam member 20. The first and second meshing members 54, 56 are held in meshing engagement at their respective arcuate portions, so that the cam member 20 is pivoted about the axis of the pivot shaft 18 by a predetermined angle in the counterclockwise direction as indicated by arrow B, as a result of depression of the pedal member 16. An amount of the pivot motion of the cam member 20 in relation with the depressing stroke of the pedal member 16 can be suitably determined depending upon a gear ratio or a ratio of diameters of the first and second meshing members 54,

56. Therefore, like in the above-described embodiment, it is possible to adjust the characteristic of the pedal reaction force applied by the compression coil spring 22, namely, the change pattern of the pedal reaction force in relation with the depressing stroke.

Please replace paragraph [0045] with new paragraph [0045] as follows:

[0045]

A pedal reaction force applying apparatus 60 of Fig. 3 is different from the above-described pedal reaction force applying apparatus 10, in that the pivot shaft 18 is located on a rear side of the pedal member 16 as viewed in the vehicle running direction so that the cam member 20 and the connecting shaft 42 are moved away from each other upon depression of the pedal member 16, and in that the compression coil spring 22 is replaced with a tension coil spring 62 to constitute a changeable reaction-force applying device 64 so that the pedal reaction force is applied to the pedal member 16 as a result of tensile deformation of the tension coil spring 62. The tension coil spring 62 is integrally fixed (engaged) at its opposite end portions to the spring seats 38, 40, and is tensed upon depression of the pedal member 16. The spring seat 40 is engaged with the outer circumferential surface of the cam member 20 such that the spring seat 40 is movable relative to the outer circumferential surface of the cam member 20 in the circumferential direction and is not separable from the cam member 20, so that the spring seat 40 is displaced following the profile of the lobe portion 34 of the cam member 20. In this embodiment, too, it is possible to suitably establish characteristic of the pedal reaction force in relation with the depressing stroke of the pedal member 16, by suitably changing the pivot amount of the cam member 20 in relation with the

depressing stroke of the pedal member 16, or by suitably changing the position, projection amount and shape of the lobe portion 34.

Please replace paragraph [0047] with new paragraph [0047] as follows:

[0047]

A pedal reaction force applying apparatus 80 of Fig. 5 is different from the pedal reaction force applying apparatus 10 of Fig. 1 in that an electric motor (stepping motor) 82 constitutes a changeable reaction-force applying device 84 for pivoting the cam member 20, and in that the pedal reaction force is changed by controlling the activation (pivot amount) of the electric motor 82 by an electronic controller 86 which has a microcomputer. The electronic controller 86 for controlling a braking force receives a signal representative of the depressing stroke of the pedal member 16, from a stroke sensor (potentiometer) 88 which electrically detects the depressing stroke. The pivot amount of the cam member 20 is controlled with the pivot motion of the electric motor 82 in its forward and reverse directions, on the basis of the depressing stroke as a parameter, according to a predetermined map or arithmetic expression, such that the pedal reaction force is changed in accordance with a predetermined non-linear change pattern. In the present embodiment in which the same cam member 20 is used as in the pedal reaction force applying apparatus 10 of Fig. 1, it is possible to obtain a reaction characteristic similar to that of the pedal reaction force applying apparatus 10 of Fig. 1, by controlling the pivot amount of the cam member 20 substantially in proportion to the depressing stroke. The electronic controller 86 and the stroke sensor 88 cooperate with each other to constitute a reaction-force controlling device 90. The

electric motor 82 corresponds to a drive device of the changeable reaction-force applying device 84.

Please replace paragraph [0049] with new paragraph [0049] as follows:

[0049]

A pedal reaction force applying apparatus 100 of Fig. 6 is different from the pedal reaction force applying apparatus 80 of Fig. 5 in construction of a changeable reaction-force applying device 102. This changeable reaction-force applying device 102 changes the pedal reaction force, i.e., the elastic deformation amount of the compression coil spring 22 by a feed screw mechanism. An externally threaded shaft 104 is screwed in an internally threaded hole formed in one 40 of the spring seats 38, 40 which one is remote from the pedal member 16. This externally threaded shaft 104 is rotatable in its forward and reverse directions through an electric motor (stepping motor) 106 controlled by the electronic controller 86, so that the spring seat 40 is linearly movable with rotation of the externally threaded shaft 104, toward and away from the connecting shaft 42, for thereby changing the pedal reaction force applied to the pedal member 16. The rotation amount of the threaded shaft 104, i.e., the position of the spring seat 40 is controlled according to the predetermined map or arithmetic expression having the parameter in the form of the depressing stroke. The pedal reaction force is thus changed according to the predetermined change pattern, thereby making it possible to obtain an effect similar to that of the above-described embodiments. The electronic motor 106 corresponds to a drive device of the changeable reaction-force applying device 102.

Please replace paragraph [0050] with new paragraph [0050] as follows:

[0050]

A pedal reaction force applying apparatus 110 of Fig. 7 is different from the pedal reaction force applying apparatus 100 of Fig. 6 in that a changeable reaction-force applying device 112 is not equipped with the electric motor 106, and in that the transmission mechanism 26 is provided in place of the reaction-force control device 90. The threaded shaft 104 is mechanically rotated through the transmission mechanism 26 and an auxiliary transmission mechanism 114 such as bevel gears, as a result of the depression of the pedal member 16, for thereby changing the amount of the elastic deformation of the compression coil spring 22, i.e., the pedal reaction force applied to the pedal member 16. Thus, in the pedal reaction force applying apparatus 110, it is possible to obtain an effect similar to that of the first embodiment.

Please replace paragraph [0052] with new paragraph [0052] as follows:

[0052]

~~**[Fig. 1]** Side views showing an outline of construction of a pedal reaction force applying apparatus to which the present invention is applied, and a case of mechanically changing a pedal reaction force by a transmission mechanism, where (a) is a state in which a pedal member is held in its home position while (b) is a state in which the pedal member is operated to be depressed.~~

[Fig. 1A] A view of a pedal reaction force applying apparatus constructed according to one embodiment of the invention, showing a state in which a pedal member is held in its home position.

[Fig. 1B] A view of the pedal reaction force applying apparatus, showing a state in which the pedal member is operated to be depressed.

~~[Fig. 2] A side view corresponding to (a) of Fig. 1, and explaining another embodiment of mechanically changing the pedal reaction force by the transmission mechanism.~~

[Fig. 2] A view of a pedal reaction force applying apparatus constructed according to another embodiment of the invention, in which a pedal reaction force is controlled by a transmission mechanism as in the apparatus of Figs. 1A and lB.

~~[Fig. 3] A side view corresponding to (a) of Fig. 1, and explaining still another embodiment of mechanically changing the pedal reaction force by the transmission mechanism.~~

[Fig. 3] A view of a pedal reaction force applying apparatus constructed according to still another embodiment of the invention, in which a pedal reaction force is controlled by a transmission mechanism as in the apparatus of Fig. 1A and lB.

~~[Fig. 4] A side view corresponding to (a) of Fig. 1, and explaining still another embodiment of mechanically changing the pedal reaction force by the transmission mechanism.~~

[Fig. 4] A view of a pedal reaction force applying apparatus constructed according to still another embodiment of the invention, in which a pedal reaction force is controlled by a transmission mechanism as in the apparatus of Fig. 1A and lB.

~~[Fig. 5] A side view corresponding to (a) of Fig. 1, and showing a case in which the pedal reaction force is adapted to be electrically controlled by an electronic controller in the embodiment of Fig. 1.~~

[Fig. 5] A view of a pedal reaction force applying apparatus constructed according to still another embodiment of the invention, in which a pedal reaction force is controlled by an electronic controller.

~~[Fig. 6] A side view corresponding to Fig. 5, and explaining another embodiment of electrically controlling the pedal reaction force by the electric controller.~~

[Fig. 6] A view of a pedal reaction force applying apparatus constructed according to still another embodiment of the invention, in which a pedal reaction force is controlled by an electronic controller as in the apparatus of Fig. 5.

~~[Fig. 7] A side view showing a case in which the pedal reaction force is adapted to be electrically controlled by the transmission mechanism in the embodiment of Fig. 6.~~

[Fig. 7] A view of a pedal reaction force applying apparatus constructed according to still another embodiment of the invention, in which a pedal reaction force is controlled by a transmission mechanism.